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Competitive Pricing Reduces Wasteful Counterproductive Behaviors

Björn Bartling^a, Manuel Grieder^b, Christian Zehnder^c

^a*University of Zurich, Department of Economics, Blümlisalpstrasse 10, 8006 Zurich, Switzerland*

^b*ETH Zurich, Department of Humanities, Social and Political Sciences, Chair of Economics, Clausiusstrasse 37, 8092 Zurich, Switzerland*

^c*University of Lausanne, Faculty of Business and Economics (HEC Lausanne), Quartier UNIL-Dorigny, Internef, 1015 Lausanne, Switzerland*

Abstract

Counterproductive reactions to unfavorable trading prices can cause inefficiencies in economic exchange. This paper studies whether the use of a competitive pricing mechanism reduces such wasteful activities. We report data from a laboratory experiment where a powerful buyer can trade with one of two sellers—an environment that can lead to very low prices for the sellers. We find that low procurement prices trigger significantly less punishment by sellers if the buyer uses a competitive auction rather than his price-setting power to dictate the same terms of trade directly. Our data suggest that the use of competitive pricing mechanisms can mitigate inefficient reactions to unequal distributions of trade surplus.

Keywords: Counterproductive behavior, competitive pricing, markets, auctions, efficiency, inequality

JEL codes: C91, D31, D63, P10

1. Introduction

Competitive markets are associated with desirable properties such as decision-making autonomy, free entry, and efficient allocation of resources. Our paper studies an additional, potentially desirable, welfare-enhancing property of competitive markets. We report experimental data showing that a competitive pricing mechanism reduces—relative to a non-competitive mechanism—wasteful counterproductive behaviors in response to unequal distributions of trade surplus. Examples for counterproductive behaviors triggered by distributive conflicts include industrial actions such as strikes, rulebook slowdowns, and acts of outright sabotage in response to low wages,¹ or quality shading by suppliers when the terms of trade are unfavorable.² The latent threat of counterproductive actions implies that judgments of the *overall* efficiency of the mechanisms used to coordinate economic activity require not only understanding their allocative efficiency but also their effects on people's reactions to the resulting outcomes. If a mechanism reduces wasteful behaviors of less favored actors it will also increase, *ceteris paribus*, efficiency. Given the central role that competition plays in business life, and many realms of society at large, it is particularly important to understand how competitive mechanisms affect wasteful counterproductive behaviors.

Email addresses: bjoern.bartling@econ.uzh.ch (Björn Bartling), manuel.grieder@econ.gess.ethz.ch (Manuel Grieder), christian.zehnder@unil.ch (Christian Zehnder)

¹Krueger & Mas (2004), e.g., report data suggesting a link between management's attempts to negotiate lower wages (and generally less favorable employment conditions) and faulty tire production at a Bridgestone/Firestone plant. Similarly, Mas (2006) shows that arrest rates decline after unfavorable arbitration outcomes for police officers.

²Research in the supply chain management and marketing literatures argues that increased pressure on terms of trade can induce trading partners to lower levels of service or product quality (see, e.g., Carter & Kaufmann, 2007; Samaha et al., 2011).

Our paper provides experimental evidence that the use of a competitive mechanism—compared to the use of power or authority—attenuates wasteful reactions to unequal monetary payoffs. Our baseline condition reflects a stylized trading situation where a powerful, monopsonistic buyer can trade with one of two sellers. The terms of trade—that is, the markup that the buyer pays on top of the seller’s cost—are reflected in the number of points that the buyer transfers to one of the sellers. It is an important feature of the experimental design that the buyer can choose between two different mechanisms to determine the transfer. He can either use his price-setting power to set the transfer directly or he can let the transfer be determined in a competitive clock auction. If the buyer uses his price-setting power, he simply dictates the transfer to one of the two sellers and trades with that seller. The other seller receives nothing. Under the competitive mechanism, in contrast, the buyer lets the two sellers compete with each other in an auction. The transfer in the auction increases automatically every second until one of the sellers accepts. The seller who first accepts receives the transfer; the other seller receives nothing. After the transfer is determined—either by use of the buyer’s price-setting power or by competition—the sellers can engage in counterproductive behaviors. This is implemented in form of a costly punishment option that allows retaliating against both the buyer and the respectively other seller.³

We find that—for given distributive outcomes—the competitive mechanism triggers less punishment for the buyer compared to when he uses his market power to set the same transfer directly. Moreover, we find that the use of the competitive mechanism leads to a partial shift of punishment. While the buyer is punished less under competition, the sellers punish each other more. Since the increase in the sellers’ mutual punishment is smaller than the reduction of the punishment of the buyer, the competitive pricing mechanism decreases the total inefficiencies that occur in response to given unequal distributions of the trade surplus.

Consider procurement auctions as one concrete example for the implications of our findings. The existing literature argues that asymmetric information about the sellers’ costs of production is the key reason for the use of procurement auctions (see, e.g., Klemperer, 1999). Our results show that buyers with strong market power, who intend to buy intermediate products from outside suppliers, may not only want to use a procurement auction because it allows elicitation of sellers’ costs, but also because it attenuates inefficiencies caused by counterproductive behaviors of sellers if prices are low.⁴

More generally, our paper adds a new angle to transaction cost economics. When comparing the costs and benefits of the use of markets versus hierarchies, the incomplete contracting literature emphasizes the trade-off between inefficiencies caused by opportunism in outsourced producer-supplier relations and bureaucracy costs in authority-based, vertically integrated firms (Williamson 1975, 1985). Buyers in our experiment do not face an explicit make-or-buy decision, but the available options—competition or power—can very naturally be interpreted as the choice between markets and hierarchies. Our results thus suggest an additional benefit of using the market: replacing authority-driven, in-house governance with a competitive market mechanism might avoid retaliatory counterproductive behaviors that may occur otherwise.

³A real-world seller can, e.g., hurt the buyer by lowering the quality of the product or service delivered. Another potential form of retaliation is malicious gossip to destroy someone’s standing. This kind of punishment can be used also by the outcompeted seller and may be targeted at both buyer and competitor. Both forms of punishment are potentially costly. The punishing seller’s reputational capital is at stake if there is a risk of detection in repeated interaction or a seller could have an intrinsic preference for delivering high quality (see, e.g., Hart & Moore, 2008; Fehr et al., 2011).

⁴In real-world procurement contexts, bilateral negotiations are arguably the most natural alternative to competitive auctions. The alternative to the competitive mechanism in our study, the use of the buyer’s price-setting power, shares all the features of a dictator game, which can be seen as a bilateral negotiation between a seller with very little and a buyer with very strong bargaining power such that the buyer is able to obtain his desired prize in the negotiation. We pick this extreme version of a bilateral negotiation, because the buyer in our experiment is endowed with strong market power if he uses the auction and it is plausible to assume that this market power is also present in bilateral negotiations of the terms of trade.

To check the robustness of our results we implemented a series of additional treatments. In a first treatment, we test whether our results are driven by self-selection of different types of buyers into different mechanisms. Sellers’ punishment decisions might, for instance, be driven by the belief that “unkind” buyers use their price-setting power, while “kind” buyers use the competitive mechanism. Hence, to isolate the effect of the mechanism itself, from the effect of the buyer’s choice, mechanisms are randomly assigned to buyers in this treatment (which is known to the sellers). In a second treatment, we study the impact of average transfer levels on punishment in the two mechanisms. Average transfers turned out to be higher under competition than under price-setting power in our baseline condition. To preclude this from affecting our results, we modified the experimental parameters to reverse this relation. In a third treatment, we add a third seller to our game to test whether increased competition affects punishment behavior. We find that all our results are robust to these design variations.

Moreover, to study possible determinants of the punishment-reducing effect of competition, we implemented three further treatments. First, we explore the extent to which our results are driven by the property of free entry under competition. In our baseline condition the buyer’s choice of competition grants all sellers an equal chance to obtain the transfer. When the buyer uses his price-setting power, in contrast, one seller is predetermined to receive the transfer. To identify the effect of symmetric participation opportunities, the additional treatment randomizes which seller gets the transfer when the buyer uses his price-setting power. This ensures that all sellers have the same chances of getting the transfer in both mechanisms. Second, we study the importance of decision-making autonomy on the sellers’ punishment behavior. In the baseline condition sellers make an active acceptance decision only under competition, but not when the buyer uses his price-setting power. We therefore introduce an active acceptance decision also in the latter case. In a final treatment, we analyze the extent to which increased buyer involvement in the competitive mechanism affects the sellers’ punishment decisions. We directly involve the buyer in the competitive transfer determination by letting him set the sequence of increasing transfers in the auction (which is known to the sellers). We find that all our results remain unaffected by these additional modifications.

The paper is organized as follows. Section 2 discusses related literature. Section 3 describes the design of our baseline condition. Section 4 presents our main results on punishment behavior. Sections 5 and 6 document the robustness of our results and study possible determinants. Section 7 investigates individual heterogeneity in sellers’ punishment behavior. Section 8 analyzes buyers’ choices. Section 9 discusses questionnaire evidence on sellers’ motivations to punish. Section 10 concludes.

2. Related Literature

The idea that the same outcome is judged differently depending on the procedure that leads to it is deeply entrenched in psychology (e.g., Thibaut & Walker, 1975) and not foreign to economics (e.g., Frey et al., 2004). The existing work on procedural fairness in economics focuses on the role of biased vs. unbiased random procedures to capture the idea of equal opportunity, “level playing field,” or ex-ante fairness (e.g., Bolton et al., 2005; Trautmann, 2009; Krawczyk & Le Lec, 2010; Sebal, 2010; Krawczyk, 2011; Brock et al., 2013; Cappelen et al., 2013). Our paper contributes to this literature by focussing on the procedure of competitive pricing. In particular, we show that the same distributive outcome triggers different punishment behavior by sellers, depending on whether the competitive pricing mechanism or the buyer’s price-setting power lead to it.

Our paper also contributes to the literature on the diffusion of responsibility. Studies in psychology show that responsibility is diffused in groups (e.g., Darley & Latane, 1968) and recent studies in economics show

that responsibility diffusion fosters selfishness in economic contexts (e.g., Dana et al., 2007; Hamman et al., 2010). The punishment pattern reported here is consistent with the general idea that responsibility diffusion affects behavior. If the buyer uses his price-setting power to determine the transfer, he is the only player who makes a decision. Under competition, in contrast, two players make a decision: the buyer chooses the mechanism and one of the sellers accepts the transfer. Responsibility is thus diffused in the latter case and we find that both punishment of the buyer and overall punishment are reduced. Relatedly, Bartling & Fischbacher (2012) show that delegating a potentially unpopular decision to another person or to a random device protects from being punished for an unequal outcome (see also Coffman, 2011 and Oexl & Grossman, 2013). Our paper shows that it is possible as well to avoid punishment by delegating the determination of the terms of trade to a competitive mechanism and “let the market decide”. The punishment-reducing effect of the competitive mechanism, however, cannot be fully explained by diffusion of responsibility and the blame-shifting effect of delegation, because it is present also in the seller acceptance treatment, where responsibility is equally diffused under both mechanisms (in the sense that always two players make a decision), and in the buyer involvement treatment, where the buyer cannot fully delegate the determination of the transfer to the competitive mechanism.

Moreover, recent experimental papers argue that people make more selfish or less moral decisions in market environments than in comparable non-market environments (see, e.g., Falk & Szech, 2013; Bartling et al., 2015; Irlenbusch & Saxler, 2015).⁵ Other papers argue that merely framing an interaction with market terminology or priming individuals to think of money reduces the importance of fairness and social considerations among interacting individuals (e.g., Hoffman et al., 1994; Ross & Ward, 1996; Vohs et al., 2006; Ellingsen et al., 2012; Cappelen et al., 2013). Our paper demonstrates that competitive pricing, a defining feature of well-functioning markets, reduces punishment in response to unequal outcomes. In Section 9 we provide questionnaire evidence suggesting that punishment in our experiment is driven by fairness concerns. Our main result—unequal distributions of trade surplus trigger less punishment under competition—is thus consistent with the above literature arguing that fairness, or morals, are of lesser importance in market contexts.

Further related work has investigated the effect of competition in ultimatum games (Güth et al., 1998; Marchand, 2001; Grosskopf, 2003; Fischbacher et al., 2009). These studies show that competition among receivers increases their willingness to accept low offers. However, the same outcome-based fairness preferences that motivate receivers to reject low offers in the standard ultimatum game can induce them to accept these low offers under competition. This is because the presence of competing receivers implies that a single receiver cannot ensure punishment of the proposer by rejecting a low offer; there is always another receiver who can accept, in which case the rejecting receiver lowers his expected payoff without affecting the proposer’s payoff (Fehr & Schmidt, 1999).⁶ In contrast, outcome-based fairness models such as Fehr & Schmidt (or Bolton & Ockenfels, 2000) cannot explain why sellers in our study punish less when the same unequal payoff distribution was determined by competition rather than by the buyer’s price-setting power. The reason is that once the transfer is determined, sellers are in the exact same strategic situation, irrespective of the underlying mechanism.

Finally, our paper is related to experimental studies by Fehr et al. (2009, 2011, 2015), who test the behavioral assumptions underlying Hart & Moore’s (2008) theory of contracts as reference points. Fehr et al.

⁵On this debate, see also Breyer & Weimann (2015), Kirchler et al. (2016), Pigors & Rockenbach (2016), and Sutter et al. (2016).

⁶A similar argument holds for ultimatum games with proposer competition, as in Roth et al. (1991).

confirm that in environments with uncertainty about the future, rigid ex ante contracts align expectations and lead to fewer ex post conflicts than flexible contracts. Fehr et al. also test Hart & Moore’s secondary behavioral assumption that contractual rigidity is particularly helpful when contracts are negotiated under competitive conditions. While Fehr et al. find support for this assumption when comparing competitively determined and exogenously given contract terms, Bartling & Schmidt (2015) and Brandts et al. (2016) show that ex ante contracts can also serve as reference points when they were negotiated under non-competitive conditions. In contrast to Fehr et al., we do not study the trade-off between rigid and flexible contracts and the importance of an exogenously given competitive environment for the emergence of contracts as reference points. Rather, we study whether the buyer’s choice of a competitive price-setting mechanism, relative to monopsonistic price-setting, limits counterproductive reactions to unequal terms of trade.

3. Experimental Design

To address our research question, we consider the following trading situation. A single buyer can trade with one of several sellers, either by using his monopsonistic price-setting power to directly set the price or by entering the sellers into price competition with each other. After the price is determined, sellers can engage in costly counterproductive behaviors. Our experimental strategy is to capture this situation in the simplest possible design.

3.1. Baseline Condition

We implement a three-player game with one buyer and two sellers. The buyer has an endowment of 90 points and the two sellers have an endowment of 10 points each. The buyer implements a transaction with one of the sellers. The transaction is executed simply by transferring an integer amount $t \in [0, 40]$ to one of the two sellers. The transfer can be interpreted as the markup that the buyer pays the seller on top of the seller’s cost. The default is that the buyer receives the entire surplus from trade (80 points), represented by his large endowment (10 points + 80 points trade surplus), but he can set a positive transfer—i.e., a price that strictly exceeds the seller’s cost—to share up to half of the surplus with the seller. The buyer decides whether to use his monopsonistic price-setting power and set the transfer directly or to let it be determined in a competitive auction. One randomly chosen seller can finally allocate costly punishment points to the buyer and/or the respective other seller.⁷

In the following we provide a step-by-step account of the game and describe each player’s decisions in detail.

Step 1: *The buyer’s choice of mechanism*

The buyer (player A) first decides whether to use his price-setting power or to employ a competitive mechanism to determine the transfer t that goes to one of the two sellers (players B and C).

- (i) If A chooses to use his price-setting power, he determines directly how many points t to transfer to the seller, as in a standard dictator game. Importantly, the transfer always goes to B in this case, and C receives nothing.

⁷Punishment in our experiment serves as a measure of discontent with the outcome from an individual seller’s point of view. Allowing only one seller to punish prevents potential strategic counter-punishment motives among the sellers, which would confound the interpretation of the punishment data. For the same reason, our design prevents a public goods problem among the sellers regarding the punishment of the buyer.

- (ii) If A chooses competition, the transfer is determined by an increasing clock auction. The transfer starts at 0 points and increases automatically by one point each second. The auction stops as soon as one of the two sellers accepts the current transfer. The transfer can thus go to either B or C, depending on who accepts first. Should the clock auction arrive at the maximal transfer of 40 points (after 40 seconds), it does not increase further.⁸

Two important features of our experimental design are worth noting at this point. First, one defining feature of perfect competition is free market entry. We capture this feature in our experimental design by granting both sellers (B and C) equal chances to receive the transfer under the competitive mechanism. We exclude one of the sellers (C) from receiving the transfer if the buyer uses his price-setting power in order to clearly differentiate the two mechanisms along the dimension of participation opportunities. This also allows us to elicit counterproductive behavior from two different types of sellers, i.e. to study whether B and C react differently to given transfers under the two mechanisms. However, in one of our additional treatments, which we describe below, we implement symmetric participation opportunities for both sellers also when the buyer uses his price-setting power. This enables us to isolate the role of equal participation opportunities.

Second, real world buyers are free to decide whether they want to run, for example, a procurement auction or employ other ways to determine the price. Providing the buyer with the choice of the price-setting mechanism is thus a realistic feature that we want to capture in our design. However, in another additional treatment, described below, we impose the mechanism exogenously. This allows separating the effect of the buyer's choice of mechanism and the effect of the mechanism in itself on the sellers' counterproductive behavior.

Step 2: *Sellers' acceptance decisions*

If A chooses the increasing clock auction to determine the transfer, B and C must independently decide when to click on an accept-button to receive the actual transfer. Accepting early results in receiving a low transfer, but waiting comes with the risk of receiving nothing as the respective other seller accepts first. Once one of the sellers accepts, the auction ends and the respective other seller cannot make a decision any longer. When the buyer uses his price-setting power to set the transfer directly, B cannot decide whether to accept or reject the transfer but simply receives the transfer determined by the buyer.

Note that by the very nature of the competitive auction, sellers choose whether or not to accept a given transfer. Indeed, decision making autonomy is an important feature of competitive mechanisms. In contrast, the seller does not have a choice if the buyer uses his price-setting power to set the transfer. We implemented this feature in our experimental design in order to differentiate the two price-setting mechanisms along the dimension of "active acceptance". However, in one of our additional treatments, discussed below, we provide B with an explicit acceptance decision also when the buyer uses his price-setting power. This allows identifying the effect of sellers' active acceptance decisions on subsequent counterproductive behavior.

Step 3: *Sellers' punishment decisions*

Once one of the sellers has received the transfer from A, the respective other seller is informed about the size of the transfer. Either B or C is then randomly selected with equal probability. The selected seller receives 5 additional points, which he can keep or use, in part or in total, to punish the other players. To destroy one point of another player, the selected seller must give up 0.1 points of his own. He can deduct a maximum of

⁸In 97.5 percent of cases it took less than 20 seconds until a seller accepted; it never took 40 seconds.

50 points in total from the other two players. Punishment can reduce a player’s profit down to 0, but we do not allow for negative monetary payoffs.⁹

We used the strategy method to elicit punishment decisions from both sellers. First both sellers decided privately how many points, if any, to deduct from the other players. Only thereafter it was randomly determined whether B’s or C’s decisions were implemented.

Table 1 displays the intermediary payoffs $\tilde{\pi}$ resulting from the game before punishment. In the table, “Power” refers to the case where the buyer uses his price-setting power to determine the transfer; “Competition” refers to the case where the buyer employs the clock auction. Table 2 shows the final payoffs π that result after punishment points p have been assigned by the randomly determined seller.

The game was played for 12 periods with fixed roles but random rematching of players. Participants received feedback about the outcomes at the end of each period. One period was randomly selected for payment at the end of the experiment.

Table 1: Intermediate payoffs before punishment

	<i>Power</i>	<i>Competition</i>	
		<i>B wins</i>	<i>C wins</i>
$\tilde{\pi}_A$	$90 - t$	$90 - t$	$90 - t$
$\tilde{\pi}_B$	$10 + t$	$10 + t$	10
$\tilde{\pi}_C$	10	10	$10 + t$

Notes: “Power” refers to the case where the buyer uses his price-setting power to determine the transfer; “Competition” refers to the case where the buyer employs the clock auction. A has an endowment of 90 points and B and C have an endowment of 10 points each. The intermediate payoffs $\tilde{\pi}$ for A, B, and C are shown as a function of the transfer t that goes from the buyer (A) to the seller (B or C).

Table 2: Final payoffs

	<i>B can punish</i>	<i>C can punish</i>
π_A	$\tilde{\pi}_A - p^A$	$\tilde{\pi}_A - p^A$
π_B	$\tilde{\pi}_B + 5 - 0.1 \cdot (p^A + p^C)$	$\tilde{\pi}_B - p^B$
π_C	$\tilde{\pi}_C - p^C$	$\tilde{\pi}_C + 5 - 0.1 \cdot (p^A + p^B)$

Notes: The table shows final payoffs π as a function of the intermediate payoff $\tilde{\pi}$ and payments relating to punishment. The seller who can punish (B or C) receives 5 points extra. Each punishment point p assigned to another player reduces the punisher’s payoff by 0.1 points. Superscripts denote the target of punishment.

3.2. Data Collection and Procedural Details

We conducted the study at the FLEX lab at Goethe-University in Frankfurt, Germany. Participants were recruited from the regular subject pool, covering all fields of study, using ORSEE (Greiner, 2015). We did not specify any exclusion restrictions. The study was computerized using z-Tree (Fischbacher, 2007).

⁹We provided subjects with “house money” and made punishment inexpensive to ensure that many subjects make use of the punishment option. Note that we are not interested in the *level* of punishment but in the *difference* in punishment between the two mechanisms under which the transfer is determined.

We ran 51 sessions with a total of 1,090 subjects. We ran nine sessions of our baseline condition and seven sessions for each of our six additional treatments, which we describe in Sections 5 and 6. We conducted two waves of sessions; the first wave in June, July, and November 2012 and the second wave in October and November 2014.¹⁰ Within the two waves of sessions, we randomly assigned treatments to sessions and, within sessions, participants to roles. We aimed at 24 subjects per session but some sessions were smaller due to no-shows. One session had 15 subjects only; all other session had at least 18 subjects.

Subjects received detailed written instructions at the beginning of a session and had to answer correctly several control questions before the experiment was started. While the participants read the instructions, they had the possibility to ask comprehension questions, which were answered in private. A summary of the instructions was finally read aloud to establish common knowledge of all features of a treatment among all types of participants.

The experiment was framed neutrally. The roles in the experiment were not labeled as “buyers” and “sellers;” instead, we simply labeled the participants as A, B, or C (or D in our “intense competition” treatment, described below). The translation of the original German instructions for the baseline condition is in the online appendix. Subjects finally answered a questionnaire containing demographics, some personality measures (see our discussion in Section 7), and open-form questions on punishment motives (see our discussion in Section 9). Role assignments, choices made, and earnings were anonymous.

Sessions lasted for 75 to 90 minutes including the reading of the instructions and the final cash payments. Subjects received a show-up fee of 10 EUR and points were converted at a rate of five points per Euro. Average total earnings were 16.42 EUR. Subjects in the role of A earned 24.06 EUR and subjects in the role of B, C, or D earned 12.78 EUR on average.

4. Results

In this section we analyze the data of the baseline condition to study the impact of the mechanism that was employed to set the transfer on the sellers’ counterproductive behavior.

4.1. Main Results

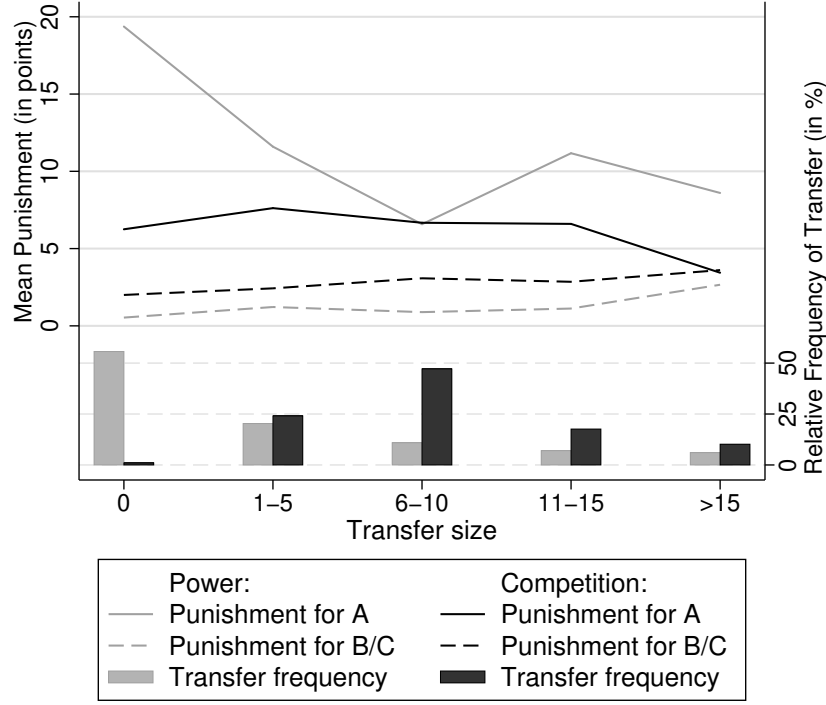
The grey bars in Figure 1 display the relative frequency of the different transfer levels when the buyer uses his price-setting power (“Power”) and the black bars show the transfers under the competitive auction (“Competition”). We aggregate transfers in bins of five to smooth random variation. Transfers of zero are displayed separately as they account for a substantial number of observations when the buyer uses his price-setting power. Transfers larger than 15 are grouped together as they are infrequent under both mechanisms. The average transfer amounts to 4.32 when the buyer sets it directly and to 9.68 under competition.

Our main interest is the punishment of the buyer for given transfers under the two mechanisms. The grey solid line in Figure 1 displays this information for the use of price-setting power and the black solid line for the use of competition.¹¹ The figure reveals that the punishment for the buyer for given transfers is lower on average under competition than when the buyer uses his price-setting power. Averaged over all

¹⁰Seven sessions of the baseline condition took place in 2012 and two in 2014 to control for unobserved changes in the subject pool that may have occurred after 2012 (we do not find evidence for such changes; see footnote 15). Treatments “symmetric participation”, “intense competition”, and “buyer involvement” were conducted in 2012, treatments “exogenous mechanism”, “seller acceptance”, and “reversed levels” in 2014.

¹¹Recall that we use the strategy method to elicit punishment. The numbers shown are the averages of all punishment decisions, irrespective of the actual implementation of a particular seller’s punishment decision.

Figure 1: Punishment patterns in the baseline condition



transfer levels, punishment of the buyer equals 15.17 points if the buyer sets the transfer directly and 6.55 points if the transfer is determined competitively.

Regression (1) in Table 3 confirms the statistical significance of the difference in counterproductive behavior across the two mechanisms. The dependent variable is the punishment for the buyers. The use of price-setting power is the omitted category and “Competition” is a dummy variable that takes on value 1 if an observation comes from the competitive mechanism and value 0 otherwise. The regression controls for the size of the transfer and the period of observation. It also includes dummy variables for each of our additional treatments and interactions with the competition dummy, which we will discuss in Sections 5 and 6.

The important observation is that the coefficient of the competition dummy is large in size, negative, and highly significant ($p < 0.001$).¹² The estimation reveals that, controlling for transfer levels, punishment is about 6.5 points lower under competition. This confirms that the use of a competitive mechanism reduces counterproductive behavior for given transfer levels.¹³

RESULT 1: Sellers punish the buyer less for given transfer levels if the transfer is determined competitively rather than by use of the buyer’s price-setting power.

The negative and significant coefficient of “Transfer” shows that punishment tends to be lower for higher transfers on average over all treatments and mechanisms, which can be seen in Figure 1 for the baseline condition and in Figure 3 for all other treatments. The negative and significant coefficient of “Period” reveals that punishment generally declines over the course of the 12 periods of the experiment. Importantly,

¹²Unless otherwise noted, p-values are from OLS regressions based on standard errors clustered at the session level.

¹³Result 1, and also Results 2 and 3 below, are robust to alternative regression specifications. Table A1 in the online appendix provides Tobit models and Tables A2 and A3 present two-part hurdle models.

Table 3: OLS regression of determinants of punishment

	(1) Punishment for A	(2) Punishment for B/C/(D)	(3) Total Punishment
Competition	-6.458*** (1.358)	1.577*** (0.411)	-4.881*** (1.393)
<i>Exogenous Mechanism</i>	-1.101 (2.190)	-0.246 (0.232)	-1.347 (2.215)
Competition X <i>Exogenous Mechanism</i>	1.296 (2.108)	-0.117 (0.580)	1.179 (2.205)
<i>Reversed Levels</i>	-0.726 (1.945)	0.070 (0.563)	-0.657 (2.074)
Competition X <i>Reversed Levels</i>	1.041 (1.881)	0.360 (0.624)	1.400 (1.951)
<i>Intense Competition</i>	-4.044** (1.961)	0.421 (0.438)	-3.624* (1.994)
Competition X <i>Intense Competition</i>	2.060 (1.694)	0.462 (0.696)	2.522 (1.667)
<i>Symmetric Participation</i>	1.991 (2.573)	0.087 (0.275)	2.078 (2.573)
Competition X <i>Symmetric Participation</i>	0.901 (1.864)	0.597 (0.548)	1.498 (1.920)
<i>Seller Acceptance</i>	0.877 (1.842)	0.513 (0.360)	1.390 (1.905)
Competition X <i>Seller Acceptance</i>	1.974 (1.477)	-0.054 (0.538)	1.920 (1.639)
<i>Buyer Involvement</i>	2.663 (2.260)	-0.443* (0.227)	2.219 (2.285)
Competition X <i>Buyer Involvement</i>	0.384 (1.573)	0.785 (0.534)	1.169 (1.547)
Transfer	-0.374*** (0.032)	0.088*** (0.011)	-0.286*** (0.035)
Period	-0.305*** (0.052)	-0.014 (0.017)	-0.318*** (0.057)
Constant	18.688*** (1.649)	0.589** (0.228)	19.277*** (1.630)
R^2	0.071	0.059	0.038
Observations	8868	8868	8868

* $p < .10$, ** $p < .05$, *** $p < .01$

Notes: Robust standard errors in parentheses, clustered by 51 sessions. Dependent variables are the number of punishment points for the buyer (1), the respectively other seller(s) (2), or in total (3). For the intense competition treatment, the dependent variable in (2) corresponds to the sum of punishment assigned to the other two sellers. Post-estimation Wald tests show that competition significantly decreases punishment for A in all treatments ($p < 0.001$; except in exogenous mechanism, where $p = 0.002$). The increase in punishment for B/C/(D) is also significant in all treatments ($p < 0.001$), as is the overall decrease in total punishment (exogenous mechanism: $p = 0.031$, reversed levels: $p = 0.015$, intense competition: $p = 0.008$, symmetric participation: $p = 0.014$, seller acceptance: $p = 0.001$, and buyer involvement: $p < 0.001$).

however, a separate analysis shows that the difference in punishment across the two price-setting mechanisms does not diminish over time.¹⁴

We next turn to the sellers’ mutual punishment. The grey dashed line in Figure 1 displays the average punishment that the sellers inflict upon each other when the buyer uses his price-setting power and the black dashed line displays mutual punishment under competition. The figure reveals that the sellers punish each other more under competition. Averaged over all transfer levels, sellers punish the respective other seller with 0.88 points when the buyer uses his price-setting power and with 2.93 points when the transfer is determined under competition. Regression (2) in Table 3 confirms the statistical significance of this effect. The dependent variable is the punishment for the respective other seller; otherwise regression equations (1) and (2) are equivalent. The coefficient of the competition dummy in regression (2), where we again control for transfer levels, amounts to about 1.6 and is highly significant ($p < 0.001$). Hence, the use of the competitive mechanism leads to a partial shift of punishment in response to the implementation of low transfers from the buyer to the respective other seller. We summarize this finding in our second result.

RESULT 2: Sellers punish each other more for given transfer levels if the transfer is determined competitively rather than by use of the buyer’s price-setting power.

Given the opposite effects of competition on the punishment targeted at the buyer and the respective other seller, the question arises whether total punishment increases or decreases. A comparison of the effect sizes displayed in Figure 1 suggests that competition reduces total punishment for given transfers. This is confirmed by regression (3) in Table 3. The dependent variable is total punishment; otherwise regression equation (3) is equivalent to regression equations (1) and (2). The coefficient of the competition dummy is negative and highly significant ($p = 0.001$). We summarize this finding in our third result.¹⁵

RESULT 3: Overall punishment—the sum of punishment targeted at the buyer and the punishment targeted at the respective other seller—for given transfer levels is lower if the transfer is determined competitively rather than by use of the buyer’s price-setting power.

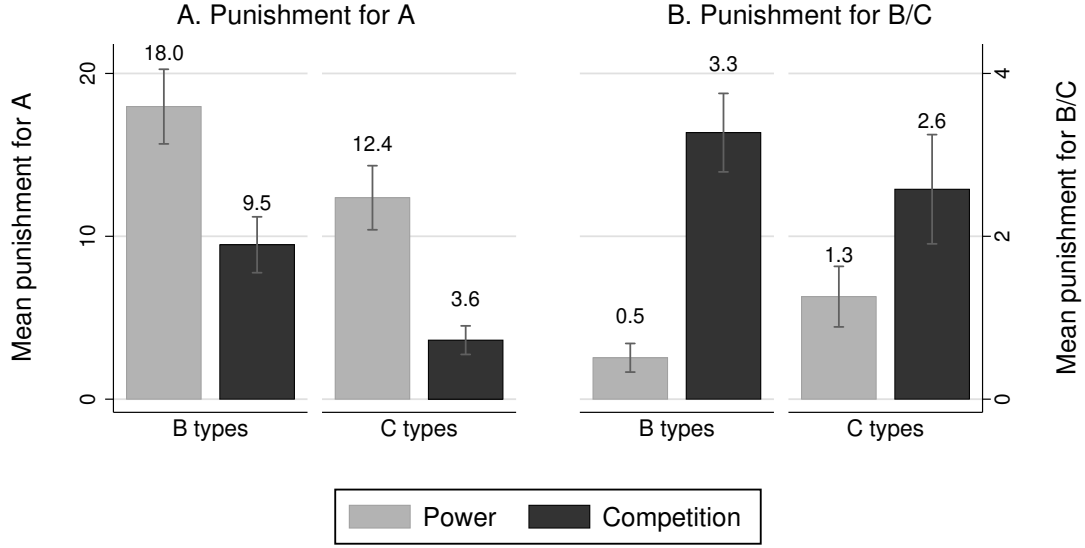
4.2. Punishment by Seller Type

Recall that the transfer always goes to seller B but never to seller C when the buyer uses his price-setting power. Cs thus have a chance to receive the transfer only when the buyer chooses the competitive mechanism. For Bs, in contrast, competition creates a risk. When the buyer uses his price-setting power, Bs receive a transfer with certainty, though it might be zero, but under competition they only receive a transfer if they accept first. This asymmetry between seller types may create different punishment motives. One might, for

¹⁴Adding the interaction effect “Competition x Period” to the models in Table 3 yields non-significant coefficients in all estimations ($p > .10$ in all three models). The effect of competition on punishment thus remains constant over time, i.e., it is unaffected by the overall decrease in punishment. See also Figure A1 in the online appendix. Note that reputation effects (which should be small in our stranger matching protocol) are unlikely to drive the decline in punishment over time. First, we observe positive punishment in the final period, which indicates that reputation effects cannot be the only factor driving punishment. Second, we do not observe an end-game effect, which indicates that reputation concerns cannot be an important factor.

¹⁵Recall that Figure 1 and Table 3 include the data from all nine sessions of the baseline condition, seven of which were conducted in 2012, while two were conducted in 2014 during the second wave of treatments (see Section 3.2). Using only the data from these nine sessions, we ran regressions equivalent to regressions (1)-(3) in Table 3 and additionally included a dummy for data from 2014 and its interaction with competition. We find that both the 2014-dummy and the interaction term are insignificant in all three regressions ($p > .10$, standard errors clustered by individual, not session, as there are nine baseline sessions only), suggesting that no substantial changes had occurred in the subject pool between 2012 and 2014.

Figure 2: Punishment by seller type



Notes: Error bars represent plus/minus one standard error of the mean, clustered by individual. The axes in the two panels are scaled differently to allow for a better presentation of the data.

instance, suspect that the higher punishment for A when he uses his price-setting power is predominantly driven by punishment from Cs who punish A for not having chosen competition.

Figure 2 displays the buyers' average punishment under the two price-setting mechanisms separately for the two types of sellers. Panel A of Figure 2 reveals that the effect of competition on the punishment for the buyer is not only driven by Cs. Both seller types punish the buyer more harshly on average when he uses his price-setting power than when he chooses the competitive mechanism to determine the transfer. Panel B of Figure 2 reveals that the increase in sellers' mutual punishment also stems from both seller types, though the effect is smaller for Cs.¹⁶ In fact, irrespective of the seller type, the increase in mutual punishment is mainly driven by the loser under the competitive mechanism.¹⁷

5. Robustness

In this section we discuss three additional treatments to study the robustness of our main results. First, we exogenously assign mechanisms to buyers to separate the role of the buyer's choice of the mechanism from the effect of the mechanism as such. Second, we implement a treatment where we reverse the average levels of the transfer that result under power and competition in the baseline condition. Finally, we study the robustness of the effect of competition on counterproductive behavior by increasing the intensity of competition.

¹⁶In the online appendix we provide additional regression analyses confirming these findings. Tables A4 to A7 report regressions equivalent to the regressions in Tables 3 (OLS) and A1 (Tobit) for both seller types separately. Results 1-3 hold for both seller types separately. The only exceptions are that the increase in sellers' mutual punishment is not significant for Cs (in both OLS and Tobit specifications) and that the decrease in total punishment is significant for the Bs only in the Tobit but not in the OLS specification.

¹⁷Table A8 in the online appendix examines punishment behavior of competition winners and losers separately. It reveals that the losers punish the winners more than the winners punish the losers ($p < 0.001$); there is no significant difference between winners and losers in their punishment for the buyer ($p > .10$).

5.1. Exogenous Mechanism

The fact that the price-setting mechanism is a choice could give rise to selection effects on the buyers' side. For example, if sellers update their beliefs about a buyer's "type" by observing the buyer's choice of mechanism, differences in punishment between the two mechanism could stem from sellers' reactions to different types of buyers rather than from their reactions to different mechanisms (e.g., Levine, 1998).

The *exogenous mechanism treatment* removes the buyer's choice of mechanism. Instead, a random device selects for each buyer and in each round with equal probability the mechanism that determines the price, thus either the competitive mechanism or the mechanism under which the buyer uses his price-setting power. Sellers know that the buyers do not choose the mechanism. The baseline and exogenous mechanism treatments are identical in all other respects. The exogenous mechanism treatment thus allows us to separate the effect of (i) the mechanism itself and (ii) the buyer's choice of the mechanism on counterproductive behavior.

Figure 3 displays transfers and punishment in all our additional treatments. Panel A shows the data for the exogenous mechanism treatment. Looking at transfers first, it is evident that there are only about half as many cases, relative to the baseline condition, in which the buyer directly sets a transfer of zero. The average transfer when the buyer uses his price-setting power in the exogenous mechanism treatment amounts to 9.00, while it is only 4.32 in the baseline condition. This difference is highly significant ($p < 0.001$) and it suggests that different types of buyers indeed self-select into the different mechanisms in the baseline condition: buyers who want to ensure a small (or even zero) transfer use their price-setting power rather than the competitive mechanism.

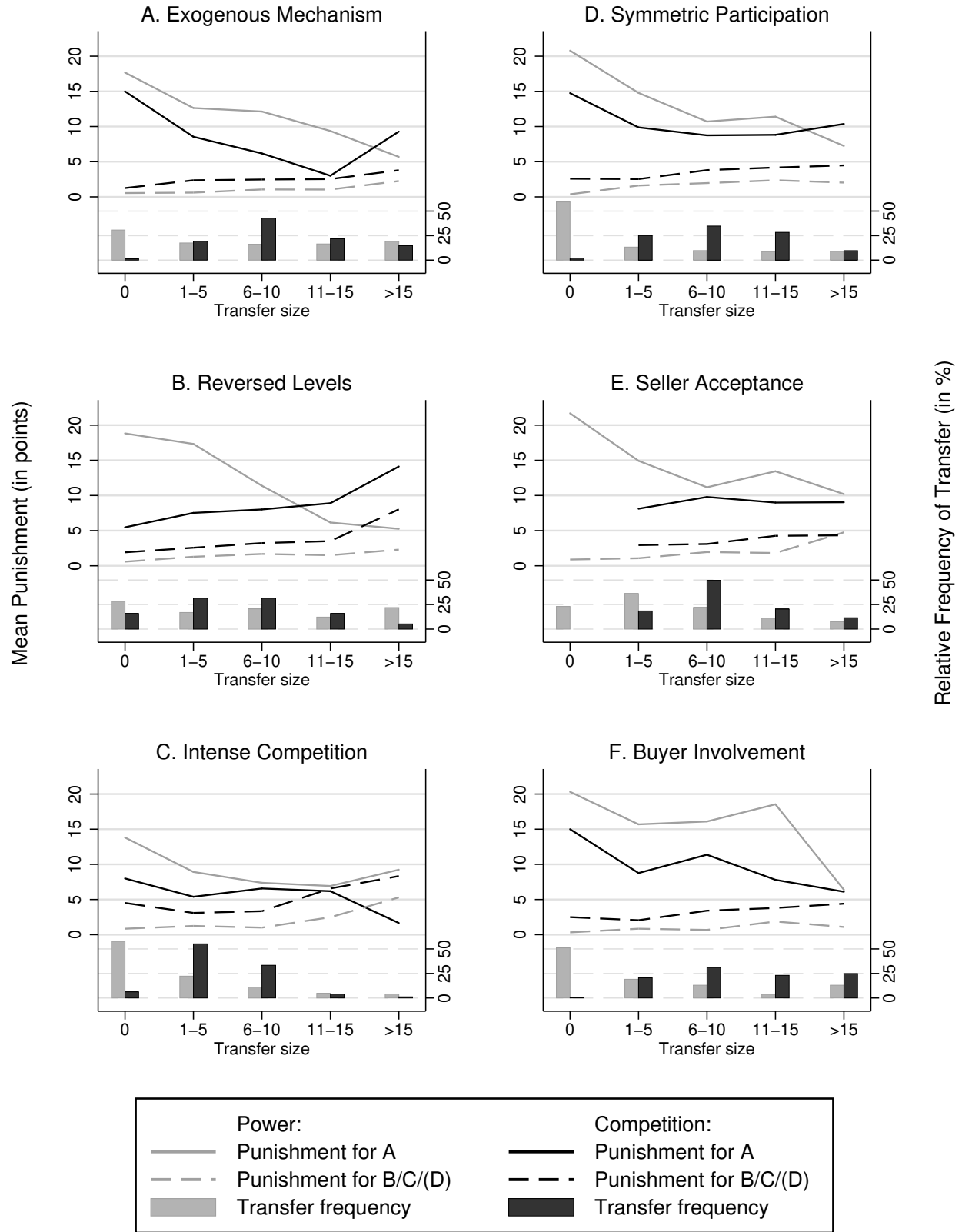
Importantly, however, Panel A of Figure 3 reveals that the punishment pattern remains qualitatively unchanged.¹⁸ This is confirmed by the regression analyses in Table 3. The regression models include treatment dummies and interactions of the treatment dummies with the "Competition" dummy. The interactions measure for each treatment whether the impact of the use of the competitive mechanism on the sellers' counterproductive behavior is different from its impact in the baseline condition. The table shows that the interaction "Competition X *Exogenous Mechanism*" is not significant for any of the regression models, indicating that punishment behavior does not significantly differ between the baseline and the exogenous mechanism treatment. This finding suggests that it is not the choice of the mechanism but the mechanism in itself that is driving our main Results 1 to 3.

5.2. Reversed Levels

The transfer levels when the buyer uses his price-setting power are determined by the buyers' generosity and the sellers' threat of punishment. The transfer levels under competition are determined by the intensity of competition and the exact design of the auction. Which mechanism generates higher transfers depends on a number of parameters (e.g., the starting point of the clock auction relative to the no trade outside option or the framing of the buyer's decision when he uses his price-setting power) and there is no generic reason why the average level of the transfer should be higher or lower under one or the other mechanism. The transfers are higher on average under competition than under price-setting power in our baseline condition (9.68 vs. 4.32). We cannot a priori exclude that this difference in average transfers has partially determined

¹⁸For transfers exceeding 15 the relation appears to flip, an effect that can also be seen in Panels B and D. This is partly due to the way the data are presented in the figure. The average transfer within the bin of transfers larger 15 is lower in "Competition" than in "Power" in all treatments because some buyers directly set the payoff-equalizing transfer of 40, while transfers exceeding 20 are rare under competition.

Figure 3: Transfers and punishment patterns in the treatment conditions



Notes: For the intense competition treatment (Panel C) the dashed lines represent the sum of punishment assigned to the respectively two other sellers.

the sellers’ counterproductive behavior under the two mechanisms in the baseline condition. For example, it is possible that sellers have judged buyers who chose competition as kinder because this choice leads to higher average transfers (e.g., Rabin, 1993; Dufwenberg & Kirchsteiger, 2004; Falk & Fischbacher, 2006).

To study whether the sellers’ counterproductive behavior is driven by the relative level of the average transfer in our baseline condition—rather than by genuine features of the two mechanisms—we conducted the *reversed levels treatment*.¹⁹ To reverse the relative average transfer level in the two mechanisms, we implemented the following two changes. First, the seller who does not receive the transfer obtains only five points under both mechanisms (instead of 10 points as in the baseline). The seller who receives the transfer still has the same endowment of 10 points (as in the baseline). This change increases the pressure to accept low transfers in the auction because already accepting a transfer of zero makes a seller better off (10 points) than not obtaining a transfer at all (5 points). Second, the buyers who use their price-setting power in the baseline condition determined the transfer by way of a scroll bar, where the default was set to zero.²⁰ In the reversed levels treatment, we replaced the scroll bar with an empty entry field, where buyers had to enter the desired transfer, i.e. no default was indicated. The distribution of transfers displayed in Panel B of Figure 3 shows that these changes reduced transfers under competition and increased transfers when buyers used their price-setting power. As intended, average transfers in the reversed levels treatment are now lower under competition than under price-setting power (6.89 vs. 9.59).

Importantly, the results presented in Table 3 show that the interaction “Competition X *Reversed Levels*” is not significant in any of the three regression models. Punishment behavior does not significantly differ between the baseline and the reversed levels treatment, indicating that Results 1 to 3 also hold if transfers are on average lower under competition.

The robustness of our results with regard to average transfer levels in the two price-setting mechanisms can also be read from Panel B of Figure 3. For small transfers (up to 10 points), the punishment targeted at the buyer is clearly lower under competition than under price-setting power in the reversed levels treatment as well. Note that this part of the transfer distribution contains the large majority of observations (72.4 percent). Since higher transfers decrease punishment much more strongly when the buyer sets the transfer directly than when it is set under competition, the solid lines cross for transfers greater than 10 points. This interaction effect between transfer size and mechanism is also present in the other treatments.²¹ The reason for this observation can be understood when considering that the buyer fully determines the transfer when he uses his price-setting power. Consequently, the buyer is punished less if he shows himself to be more generous. Under competition, in contrast, the buyer has no control over the resulting transfer any longer, hence punishment does not decrease as much when a relatively large transfer results under competition.

5.3. Intense Competition

A decisive characteristic of any competitive mechanism is its intensity. The more intense the competition between sellers, the lower is the expected transfer. The intensity of competition might thus be an important

¹⁹We devised this treatment ex post, after observing the results of the baseline condition.

²⁰We implemented the choice of the transfer by way of moving a scroll bar with a zero transfer default position in order to closely mimic the fact that the transfer starts at zero in the clock auction as well. For the decision screens in the baseline condition see the experimental instructions in the online appendix.

²¹Including the interaction term “Competition X Transfer” in model (1) of Table 3 reveals that it is positive and highly significant ($p < 0.001$) when pooling all treatments together. On the treatment-level, we find a significant “Competition X Transfer” interaction in the baseline ($p = 0.004$), symmetric participation ($p = 0.018$), seller acceptance ($p < 0.001$), intense competition ($p = 0.022$), and reversed levels ($p < 0.001$) treatments, but not in the buyer involvement treatment ($p = 0.119$). See also footnote 18.

determinant of the perceived fairness of a competitive mechanism. To study the influence of this factor on counterproductive behavior, we increase the number of sellers in the *intense competition treatment* by adding a player D, who is a “clone” of C in every respect. Thus, if A chooses competition, there are now three sellers (B, C, and D) who compete for receiving the transfer. If A chooses to use his price-setting power, the rules are as in the baseline condition in that the transfer always goes to B.²²

Comparing the distribution of the transfers under competition in the intense competition treatment, shown in Panel C of Figure 3, with the distribution in the baseline condition reveals that increased competition leads, as expected, to lower competitive transfers. The average competitive transfer amounts to 5.88 in the intense competition treatment, which is significantly lower than the average competitive transfer of 9.68 in the baseline ($p = 0.001$).²³ This proves that competition for transfers is indeed harsher when a third seller is present.

Importantly, however, the punishment pattern shown in Panel C of Figure 3 is again qualitatively identical to the baseline condition, which is confirmed by the insignificance of the interaction term “Competition X *Intense Competition*” in all three models in Table 3. Results 1 to 3 thus hold under intensified competition.

6. Potential Determinants

In this section we discuss three additional treatments to analyze potential determinants of our results, such as the sellers’ participation opportunities, active acceptance decisions, and the buyer’s involvement in the competitive mechanism. In contrast to the three treatments in the previous section—where our ex-ante hypothesis was that the treatment manipulations would not affect the main results—we hypothesized for the three treatments that follow that they would reduce or eliminate the differences in punishment between the two price-setting mechanisms, thereby pointing to drivers behind our findings.

6.1. Symmetric Participation

To identify the impact on counterproductive behavior of the participation asymmetry between Bs and Cs when the buyer uses his price-setting power in the baseline condition, we provide symmetric participation opportunities under both mechanisms in the *symmetric participation treatment*. Specifically, if the buyer uses his price-setting power in the symmetric participation treatment, he first sets the transfer and it is then randomly determined, with equal probability, whether B or C receives the transfer. If the buyer chooses competition, the rules are exactly as in the baseline condition.

Our analysis in Section 4.2 revealed that the punishment pattern observed in the baseline condition is not driven by one particular seller type. This does, however, not necessarily exclude that the asymmetry between Bs and Cs is an important driver of our results. It is possible, for example, that the buyer’s use of his price-setting power is perceived as relatively unfair by both B and C, because it favors player B and prohibits player C from getting a transfer. The symmetric participation treatment allows us to identify the importance of the participation asymmetry between Bs and Cs.

Panel D of Figure 3 shows that the punishment pattern in the symmetric participation treatment is very similar to the baseline. The regression results in Table 3 confirm that punishment in the symmetric

²²Recall that we use the strategy method to elicit punishment decisions. The presence of player D thus reduces the probability that a given seller’s punishment decision is implemented from 1/2 to 1/3.

²³The reported p -value stems from a regression of transfers on treatment dummies with standard errors clustered by session. Using session-averages and a non-parametric ranksum test, the transfers are also found to be significantly lower in the intense competition treatment compared to the baseline ($p = 0.005$).

participation treatment does not significantly differ from the baseline. The interaction of the treatment variable “*Symmetric Participation*” with “Competition” is not significant in any of the regression models. This suggests that the asymmetric participation opportunities when the buyer uses his price-setting power do not drive our main Results 1 to 3.

6.2. Seller Acceptance

Decision making autonomy is an integral feature of any competitive mechanism. On the one hand, it means that everybody is free to reject given terms of trade—even if this implies not trading at all. On the other hand, it means that a transaction always involves an active decision to accept the terms of trade—even if these terms are unattractive. The feature of “freedom of choice” is mirrored in our experimental design as it is the sellers’ choice whether or not to click on an accept-button to receive the transfer under the competitive mechanism. In contrast, B does not have a choice when the buyer uses his price-setting power in our baseline condition because the transfer is simply dictated by the buyer.

The *seller acceptance treatment* introduces an acceptance decision also when the buyer uses his price-setting power. If A uses his price-setting power in the seller acceptance treatment, B receives the transfer only if he accepts it by clicking on an accept-button—exactly as under competition. If B does not accept, the transfer goes to C, who then automatically has to accept.²⁴ The competitive mechanism is identical to the baseline condition.

Panel E of Figure 3 and the regression results in Table 3 show that sellers’ punishment behavior in the seller acceptance treatment does not differ significantly from the baseline condition. However, since the acceptance decision is held constant between the two mechanisms only for Bs, we also run regressions with the data from the Bs only (recall that Figure 3 and Table 3 consider data from Bs and Cs jointly). These estimations do not reveal any significant differences between the two treatments either. The coefficient for the “Competition X *Seller Acceptance*” interaction term is not significant in either model, i.e. the effect of competition is the same as in the baseline condition when it comes to the punishment for the buyer ($p = 0.184$), for the respective other seller ($p = 0.761$), or in total ($p = 0.178$).²⁵ Based on these results, we conclude that the active acceptance decision present in the competitive mechanism is not a key driver of Results 1 to 3 that we identify in the baseline condition.

6.3. Buyer Involvement

The clock auction that is used to determine the transfer under the competitive mechanism is completely detached from the buyer. In particular, once A has chosen the competitive mechanism, the transfer is determined entirely by the acceptance decisions of B and C—without any further involvement of A. This might allow the buyer to hide behind the forces of competition and to avoid possible blame for low transfers. In the real world, however, buyers often remain involved in the determination of the terms of trade even under competitive mechanisms. Consider, for example, a situation where a buyer simultaneously engages in competitive negotiations with multiple potential sellers.

²⁴We did not give C the option to reject the transfer in order not to affect A’s incentives. Since C cannot reject, A knows that the transfer will be implemented for sure—exactly as in the baseline condition. Bs accepted transfers of 1-5, 6-10, 11-15, and >15 in 82.3, 95.7, 89.7, and 100 percent of the cases, respectively. They accepted transfers of zero in 37.9 percent of the cases, but this is an inconsequential choice.

²⁵The p-values stem from OLS regressions reported in full in Table A4 in the online appendix. Table A5 reports Tobit regressions.

We give A an active part in the auction in the *buyer involvement treatment* in order to study whether an involvement of the buyer in the competitive mechanism affects the sellers’ counterproductive behaviors. In particular, if A chooses competition, he first has to set a sequence of 10 strictly increasing transfer offers (the sequence cannot increase further if it reaches the maximum transfer of 40 before the tenth offer). In the actual auction, A’s transfer offers are then shown to B and C in increasing order.²⁶ As in the baseline condition, the seller (B or C) who first accepts an offer receives the transfer. If none of A’s 10 offers is accepted, the highest transfer offer is automatically increased by one point each second (up to the maximum transfer of 40) until one of the sellers accepts. The rules are exactly as in the baseline condition if A chooses to use his price-setting power.

Panel F of Figure 3 reveals a very similar punishment pattern in the buyer involvement treatment compared to the baseline condition. The regression analysis in Table 3 confirms this result. The interaction of the treatment variable “*Buyer Involvement*” with “*Competition*” is not significant in any of the regression models.²⁷ These results suggest that involving the buyer in the competitive mechanism does not affect our main Results 1 to 3.

7. Individual Heterogeneity

In this section, we analyze individual heterogeneity in punishment decisions. For example, across all treatments 24.6 percent of the sellers (B, C, or D) never deduct any points from any other player during the 12 periods of the experiment.

The regressions reported in Table 4 show the extent to which unobserved individual differences explain the variation in punishment decisions. The dependent variable in all regressions is the punishment for the buyer. Model (1) considers “*Competition*”, “*Transfer*”, and “*Period*” as explanatory variables and uses the data from all our treatments. This regression confirms our main finding that the use of a competitive mechanism reduces the punishment for the buyer. A comparison of column (1) with column (2) illustrates that including individual fixed effects does not alter the coefficients much, but simply increases the R^2 from about 6 percent to 56 percent. Unobserved individual differences thus explain the largest part of the variance in punishment decisions. However, since the assignment of subjects to roles and treatments is random and interactions were anonymous, our experimental design allows for a clean identification of the effect of the mechanism on punishment, despite the presence of large individual heterogeneity.

Regression (3) extends regression (1) by adding a “*Female*” dummy and its interaction with “*Competition*” to the explanatory variables. Our sample is relatively balanced, with 52.3 percent of subjects (570 of 1,090) being female. We find that our main result—the reduction of the punishment when the buyer uses a competitive mechanism to set the transfer—is significantly less pronounced for women than for men. This can be seen by the positive sign of the coefficient for the interaction of “*Competition*” and “*Female*”. Moreover, the negative sign of the “*Female*” dummy reveals that women punish less than men in general.

²⁶The buyer’s sequence of transfer offers was displayed on the sellers’ screens before the start of the auction. Moreover, we slowed down the clock auction from 1 second to 1.5 seconds because it is cognitively more demanding for the sellers to process the buyer’s sequence of increasing offers than to follow the standard clock auction with constant increments of 1 point.

²⁷Involving the buyer in the determination of the transfer slightly increases the transfer level under competition (12.02) relative to the baseline condition (9.68). This difference is marginally significant in a regression of transfers on treatment dummies with standard errors clustered by session ($p = 0.052$) but not in a non-parametric ranksum test using session averages ($p = 0.244$). We do not detect systematic effects of buyers’ transfer sequences on punishment. Buyers’ sequences can be characterized by the first transfer (starting point), the last transfer (end point), and the mean transfer. When regressing punishment for the buyer on these independent variables and controlling for transfer size and period, we find no significant effects (first transfer = 0.076, $p = 0.692$; mean transfer = -0.193 , $p = 0.559$; last transfer = 0.062, $p = 0.707$; OLS regression clustered by individual).

Table 4: Individual heterogeneity in sellers' punishment of the buyer

	Punishment for A			
	(1)	(2)	(3)	(4)
Competition	-5.470*** (0.476)	-5.043*** (0.376)	-7.525*** (0.728)	-7.595*** (0.722)
Transfer	-0.341*** (0.033)	-0.477*** (0.032)	-0.344*** (0.033)	-0.339*** (0.031)
Period	-0.303*** (0.052)	-0.316*** (0.056)	-0.301*** (0.052)	-0.301*** (0.052)
Female			-4.015*** (1.014)	-3.920*** (1.081)
Competition X Female			3.982*** (0.978)	4.135*** (0.972)
Agreeableness				-0.951 (0.758)
Extraversion				-0.401 (0.532)
Openness				-1.514** (0.679)
Neuroticism				0.056 (0.613)
Conscientiousness				0.082 (0.606)
Constant	18.359*** (0.847)	19.260*** (0.449)	20.447*** (0.950)	30.927*** (5.146)
R^2	0.059	0.561	0.066	0.072
Observations	8868	8868	8868	8868

* $p < .10$, ** $p < .05$, *** $p < .01$

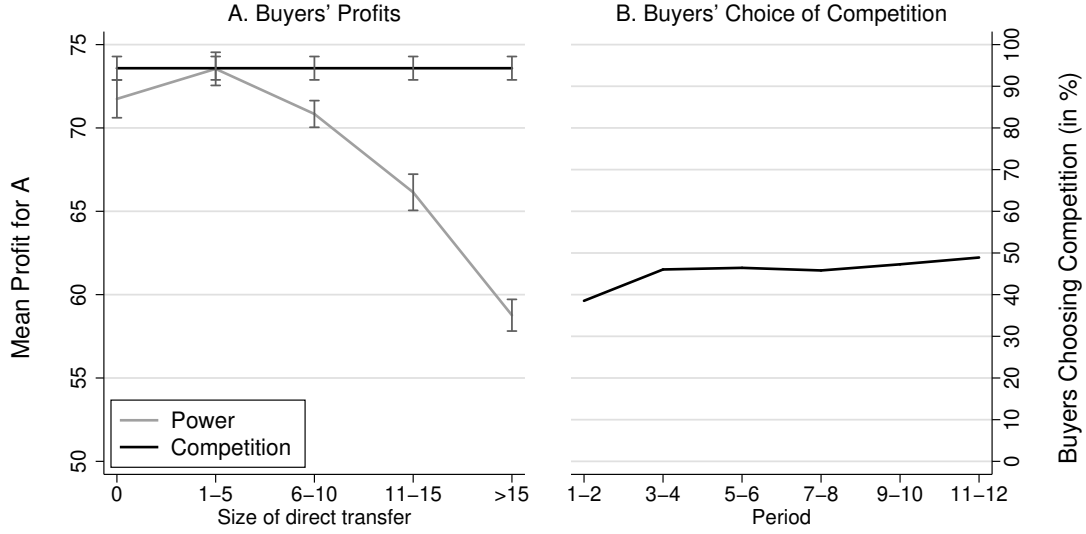
Notes: OLS; robust standard errors, clustered by 51 sessions, are in parentheses. The dependent variable is the number of punishment points assigned to the buyer. Big Five traits included in model 4 were measured in the post-experimental questionnaire using a German translation (Streib & Wiedmaier, 2001) of the mini-IPIP scale (Donnellan et al., 2006). Each trait was measured by four items on five-point Likert scales. Cronbach's α indicate the following measurement reliabilities: Agreeableness $\alpha = 0.660$, Extraversion $\alpha = 0.751$, Openness $\alpha = 0.603$, Conscientiousness $\alpha = 0.740$, and Neuroticism $\alpha = 0.701$.

Regression (4) shows that these results also hold when we control for a number of personality dimensions that are potentially correlated with gender.²⁸

We want to stress that we did not have an ex-ante hypothesis regarding a gender effect, hence it should be interpreted cautiously. However, the observation that the punishment reducing effect of competition in our data is less pronounced for women than for men resonates with the existing literature showing that women have a less pronounced preference for competition compared to men (e.g., Gneezy et al., 2003; Gneezy & Rustichini, 2004; Niederle & Vesterlund, 2007; Croson & Gneezy, 2009). Our data suggest that this gender difference in preferences for competition extends to counterproductive behaviors in reaction to outcomes of competitive mechanisms.

²⁸The only personality dimension that has a significant main effect on punishment is Openness. More importantly, additional regression analyses show that none of the personality measures included in Model 4 in Table 4 show a significant interaction with the competition dummy. Moreover, the interaction between competition and gender remains significant.

Figure 4: Buyers' profits and mechanism choices over time



Notes: The figure presents pooled data from all treatments. Error bars in Panel A represent plus/minus one standard error of the mean, clustered by session. Panel A excludes data from the buyer involvement treatment and Panel B excludes data from the exogenous mechanism treatment.

8. Buyers' Profits and Choice of Mechanism

The fact that the choice of competition reduces the punishment that sellers inflict on the buyer (for given transfer levels) renders competition potentially attractive for buyers. However, giving up power and delegating the transfer determination to a competitive auction also means that the buyer loses control over the resulting transfer. In this section we examine the impact of the buyers' choices of mechanism on their profits in our experiment.

In Panel A of Figure 4 we display expected final profits of the buyers—after punishment—for both mechanisms. This allows identifying the optimal strategy for a money-maximizing buyer. The profit that buyers can expect when choosing power depends on the transfer they set and the average punishment they get in response to that transfer. The grey line therefore shows the average final profit of the buyer as a function of the transfer that buyers choose when they make use of their price-setting power. The black line illustrates the expected final profit when the buyer chooses competition. It is horizontal because under competition buyers cannot control the transfer level but instead simply face an expected final profit, which is determined by the average transfer and the average punishment that results under competition.²⁹ The figure reveals that buyers cannot realize higher (expected) final profits when they use their price-setting power instead of competition. When taking the punishment reactions of sellers into account, buyers can maximize their expected profit either by making use of the competitive mechanism or by directly setting a small transfer, slightly greater than zero.

Consistent with these observations, Panel B of Figure 4 shows that buyers make use of the competitive

²⁹This does not hold in the buyer involvement treatment, where the buyer can affect, to some degree, the expected profit under competition by choice of the sequence of transfers that is shown to the sellers. This is why we exclude this treatment in Panel A of Figure 4, which pools the data from all other treatments. Figure A2 in the online appendix shows the data for each treatment separately, including a graph for the buyer involvement treatment, and reveals that the same qualitative pattern prevails in all treatments.

mechanism with increasing frequency over the course of the 12 periods of the experiment.³⁰ While buyers choose competition in less than 40 percent of the cases in the first two periods, the share increases to levels close to 50 percent in the last two periods of the experiment. On average over all treatments (except exogenous mechanism) and periods, buyers choose competition in 46.9 percent of all cases.³¹

9. Questionnaire Evidence

The different treatments of our experiment consistently show that the use of a competitive pricing mechanism reduces wasteful counterproductive reactions to unequal distributions of the trade surplus. However, with behavioral data alone it is challenging to disentangle the different psychological mechanisms that may drive our results. To cast some light on the motives behind punishment decisions, we report questionnaire evidence that we collected after the decision-making part of the experiment. We confronted sellers with three different scenarios and asked them in open-form questions about their motives to punish. In the first vignette, the “direct transfer” scenario, we asked the sellers to imagine that the buyer had decided to use his price-setting power to set a transfer of 10 points. In the second scenario, “winning in competition,” we asked them to imagine that the buyer had used the competitive mechanism and that they had accepted a transfer of 10 points in the clock auction. Finally, in the “losing in competition” scenario we asked them to imagine that their competitor in the auction had clicked first and accepted a transfer of 10 points. After each scenario we asked the sellers the following question: “Based on what criteria and thoughts did you make your decision regarding the deduction of points in this or similar cases during the study?”

Three research assistants, who were unaware of the research questions addressed in our experiment, independently coded the answers of the 136 sellers in the baseline condition. We defined coding categories based on the punishment motives that have been discussed most prominently in the literature, such as *fairness* (under which we subsumed general fairness motives, inequity aversion, and reciprocity, see, e.g., Fehr & Schmidt, 1999; Bolton & Ockenfels, 2000; Charness & Rabin, 2002; Dufwenberg & Kirchsteiger, 2004; Falk & Fischbacher, 2006), *emotions* (e.g., Pillutla & Murnighan, 1996), and *responsibility attribution* (e.g., Bartling & Fischbacher, 2012). In addition, we considered categories that seemed potentially important in our specific experimental set-up, such as *inclusion/exclusion of C* (see our discussion of symmetric participation and related arguments in Sections 4.2 and 6.1), *reputational concerns* (though such concerns should be minimal given our random stranger matching protocol), *solidarity between sellers* (which may arise because sellers identify with each other and thus punish each other less, as social identity theory might suggest, see e.g., Tajfel & Turner, 1986; Akerlof & Kranton, 2000), and the *cost of punishment* that could keep sellers from punishing. Coders could assign an answer to multiple coding categories, if applicable.³²

Table 5 provides an overview of the frequency with which participants mentioned the various motives for or against punishment in the three scenarios.³³ We find that the cost of punishment, mentioned mostly as

³⁰Figure A3 in the online appendix shows that the increasing trend prevails in each treatment individually.

³¹This percentage does not differ very much across treatments: 49.4 (baseline), 58.0 (reversed levels), 39.2 (intense competition), 43.1 (symmetric participation), 46.1 (seller acceptance), and 46.4 (buyer involvement). Recent papers showed that many people have a preference for remaining in control (e.g., Fehr et al., 2013; Bartling et al., 2014), which might explain why the determination of the transfer is not more frequently delegated to the competitive mechanism. However, the positive time trend is highly significant when pooling the treatments together ($p < 0.001$) and it is at least marginally significant in the treatments separately, except in the seller acceptance treatment.

³²The online appendix provides more detail on the coding procedures as well as more detailed definitions of the coding categories.

³³When reporting the results we only rely on codings on which at least two of the three coders agreed. Krippendorff (2004, p. 219) recommends using at least three coders and suggests majority decisions as one possible “formal decision rule” to assign

a reason against engaging in punishment, is the most frequently coded category. This illustrates that the monetary cost of punishment was a relevant consideration for the participants in our experiment. Fairness motives, mentioned mostly as a reason in favor of punishment, is the second most frequently mentioned category.

Table 5: Overview of coding data

	In favor of punishment	Against punishment
Fairness ($\alpha = .736$)	70	12
Emotions ($\alpha = .600$)	16	3
Responsibility ($\alpha = .581$)	29	10
Exclusion/inclusion of C ($\alpha = .233$)	2	1
Solidarity B/C ($\alpha = .494$)	0	4
Reputational concerns ($\alpha = .843$)	6	1
Cost of punishment ($\alpha = .713$)	1	185

Notes: Codings based on responses from 136 participants in the role of seller (B or C) in the baseline. The table only reports codings where at least two of the three coders agreed. Coders could assign multiple coding categories to one answer and participants could mention the same reason in different scenarios. The table shows the sum of codings across the three scenarios. Krippendorff’s α reported in parentheses as a measure of inter-coder agreement.

Table 6 focuses on the reasons participants mentioned in favor of punishment, differentiated by the three scenarios and the punishment target (the buyer or the respectively other seller).³⁴ The table allows understanding the motives behind punishing the buyer and the respective other seller, and how these motives differ under the two mechanisms.

First, we find that arguments for punishing the buyer (player A) are put forward significantly more often in the “direct transfer” scenario (42 codings) than in any of the two competition scenarios (16 codings in “winning in competition”, $p = 0.008$, and 15 codings in “losing in competition”, $p = 0.007$).³⁵ Reasons to punish the respectively other seller (player B or C), in contrast, are mentioned predominantly in the “losing in competition” scenario (37 codings) and significantly less in the “winning in competition” (5 codings, $p = 0.018$) and “direct transfer” (4 codings, $p = 0.008$) scenarios.

Second, in line with the general punishment pattern, sellers report fairness issues most frequently in the “direct transfer” scenario (35 codings) and to a significantly lesser extent in the “winning in competition” (15 codings, $p = 0.017$) and the “losing in competition” (20 codings, $p = 0.009$) scenarios. In the “losing in competition” scenario, besides fairness issues, (negative) emotions (13 codings) and responsibility attributions (18 codings) also seem to be reasons for why losing sellers punish winning sellers. Other punishment motives generally play a minor role only.

The questionnaire data suggest that the use of the competitive mechanism reduces counterproductive behavior because sellers perceive a given unequal distribution of the trade surplus as less unfair when it was determined competitively than when the buyer used his price-setting power. This interpretation is consistent

final codes. As a measure of intercoder-agreement we report Krippendorff’s α , which is considered as the most conservative reliability measure (Hayes & Krippendorff, 2007). For all frequently mentioned categories, the reliability is either good (fairness, cost of punishment) or close (emotions, responsibility) to the cut-off value proposed by Krippendorff ($\alpha = 0.667$).

³⁴Table B1 in the online appendix provides the same results for reasons *against* punishment.

³⁵The p-values in this section stem from Wilcoxon signed-rank tests on the coding data collapsed at the session level ($n = 9$ baseline sessions) in order to account for potential non-independence within sessions.

Table 6: Frequency of motives *in favor of* punishment differentiated by target

<i>Scenario: Reason for punishing:</i>	Direct Transfer				Winning in Compet.				Losing in Compet.			
	A	B/C	unsp.	Σ	A	B/C	unsp.	Σ	A	B/C	unsp.	Σ
Fairness	30	3	2	35	13	2	0	15	11	8	1	20
Emotions	2	0	0	2	0	1	0	1	1	11	1	13
Responsibility	6	1	0	7	2	2	0	4	2	16	0	18
Inclusion of C	2	0	0	2	0	0	0	0	0	0	0	0
Solidarity B/C	0	0	0	0	0	0	0	0	0	0	0	0
Reputation	2	0	1	3	1	0	0	1	1	1	0	2
Cost of punishment	0	0	0	0	0	0	0	0	0	1	0	1
Σ	42	4	3	49	16	5	0	21	15	37	2	54

Notes: Codings based on responses from 136 participants in the role of seller (B or C) in the baseline. The table only reports codings where at least two of the three coders agreed. Coders could assign multiple coding categories to one answer and participants could mention the same reason in different scenarios. Coders distinguished between the targets of an indicated punishment motive (either the buyer A or the other seller B or C) whenever possible. The columns labeled “unsp.” (for “unspecified”) capture the cases in which no such distinction could be made. The columns labeled “ Σ ” indicate the sum of the number of codings for a given motive in a given scenario. The last row provides the sum of codings for each column.

with the social preference literature, where negative reactions to unequal distributions are often explained by perceived fairness violations (see, e.g., Fehr & Schmidt, 1999). Moreover, the questionnaire data suggest that losing in competition may trigger negative emotions and that the losing competitor attributes some of the responsibility for the negative outcome to the winner. However, subjects’ answers in our questionnaire may be affected by ex post rationalizations and other biases, and we do therefore not want to over-interpret these results. Nevertheless, the questionnaire evidence provides complementary information that allows a better understanding of the psychological mechanisms behind our behavioral results.

10. Conclusions

Competitive markets are associated with desirable properties such as decision-making autonomy and free entry. This paper asked whether competitive mechanisms also reduce wasteful counterproductive behavior in response to unequal distributions of the trade surplus. To address this question, we conducted a series of laboratory experiments. In a stylized trading environment, a single powerful buyer could trade with one of several sellers, and sellers could subsequently engage in inefficient counterproductive behaviors. We find that low procurement prices, which allocate most of the surplus from trade to the buyer, trigger significantly less counterproductive behavior if the buyer uses a competitive auction to determine the terms of trade than if he uses his price-setting power to dictate the same terms directly.

Data from a post-experimental questionnaire suggest that fairness perceptions played an important role for participants’ punishment decisions. The data indicate that sellers perceive the same unequal payoff distribution as less unfair when it is the result of a competitive mechanism rather than the result of the buyer’s price-setting power. This suggests that competitive mechanisms, besides their capability to produce efficient allocations, also provide justification for economic inequality. Further testing this hypothesis is an exciting avenue for future research.

It will also be interesting to explore the behavioral consequences of competition in other environments. In this paper, we implemented an arguably very balanced manifestation of a competitive procedure, where all sellers have the same chance of winning the deal. It would thus be interesting to study more asymmetric

competitive mechanisms that provide advantages to some players because many real-life markets do not perfectly “level the playing field”, for instance due to an incumbent advantage.

Similarly, it would be interesting to enrich the environment by extending the action set. In some situations, efficient trade not only necessitates limiting harmful behavior, but also requires inducing proactive behavior, initiative, or voluntary cooperation, for instance effort beyond the letter of the contract. It would be interesting to examine whether the use of competition also allows motivating trading partners to engage in such productive behaviors.

Finally, in this paper we have focused on situations in which punishment is purely wasteful. However, there are also contexts where conflictual reactions to economic inequality may be desirable from a long-term perspective. In particular, the justification for economic inequality that appears to be provided by competitive mechanisms may weaken political and societal pressure for redistribution, thereby perpetuating or even fostering inequality in society. While a certain level of merit-based inequality is needed to sustain incentives, excessive inequality can result in misallocation of resources and be harmful to economic growth (e.g., Aghion et al., 1999; Barro, 2000) and other important societal outcomes such as crime (e.g., Kelly, 2000), health (e.g., Deaton, 2003), or trust (e.g., Gustavsson & Jordahl, 2008). The punishment-reducing effect of competitive mechanisms that we identified in this paper might thus be undesirable in contexts with excessive inequality, where costly conflicts can have beneficial long-run effects. We hope that future research—using dynamic designs allowing to capture long-term effects of conflicts—will shed more light on this important point.

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